EC4610 Course Outline

I. INTRODUCTION (Vol. I)
- Basic concepts
- Radar functions and classifications
- Derivation of the radar range equation
- Noise in radar systems
- Noise temperature; noise figure; signal-to-noise ratio
- Fundamental design tradeoffs and system block diagrams

II. ANALYSIS OF RADAR SYSTEMS (Vol. I)

Review
- Fourier transforms; spectrum of a pulse train
- Basic probability and statistics; distributions
- Linear systems; impulse response and transfer functions
- Frequency response of cascaded linear systems
- Mixing (heterodyning)

Radar system design
- Probability of false alarm; probability of detection
- Integration of pulses; processing gain

Radar cross section (RCS)
- Definition of RCS
- Scattering mechanisms
- RCS of typical targets (aircraft, ships, ground vehicles, etc.)
- RCS reduction methods; stealth philosophy
- Fluctuating targets: Swerling types
- Probability of detection for fluctuating targets

III. DOPPLER EFFECT AND CW RADARS (Vol. II)
- Doppler shift
- Continuous wave (CW) radar
- Doppler filtering
- Transmit/receive isolation
- Frequency modulated CW (FMCW) radar

IV. AIRBORNE RADARS (Vol. II)
- Moving target indication (MTI)
- Pulse doppler radar; ambiguities
- Clutter illumination conditions
- Clutter spectrum
- Delay line cancelers; range gates; FFT
- Noncoherent MTI and improvement factors

V. MICROWAVE DEVICES (Vol. III)

Transmission line refresher
- Passive devices
- Filters; multiplexers
- Circulators; isolators

Active devices
- Power amplifiers: tubes and solid state devices
- Low noise amplifiers

Radar antennas
- Antenna parameters
- Reflectors; sidelobe control
- Arrays; grating lobes; scanning
- Multibeam antennas; active antennas; photonics

VI. SEARCH VS TRACKING RADARS (Vol. III)
- Search vs track functions; search radar equation
- Monopulse; conical scan
- Low angle tracking; multipath; frequency diversity

VII. RADAR RECEIVERS (Vol. III)
- Matched filters
- Analog and digital pulse compression (chirp)
- Ambiguity diagrams; measurement accuracy; resolution

VIII. SPECIAL RADAR SYSTEMS (Vol. IV)
- Synthetic aperture radar (SAR)
- Ultra-wideband radar (UWB)
- Stepped frequency radar
- Laser radar
- High frequency over-the-horizon radar (HF)
- Bistatic radar
- Weather radar
- Ground penetrating radar (GPR)